

## REMARKS

### ACKNOWLEDGEMENT OF RCE ACCEPTANCE

Applicant appreciatively acknowledges that the Request for Continued Examination submitted with the Office Action Response of May 16, 2008 has been entered and that the finality of the previous Office Action was removed.

### AMENDMENTS TO CLAIMS

Claim 224 is amended to recite:

A method of causing plural input signals representing respective channels to appear to emanate from respective different positions in space, said method comprising:

providing a sound reflective or resonant surface at each of said positions in space;

providing, **in one enclosure**, an array of **at least 6** output transducers distal from said positions in space; and

directing, using said array of output transducers, sound waves of each channel towards the respective position in space to cause said sound waves to be re-transmitted by said reflective or resonant surface;

said step of directing comprising:

obtaining, in respect of each transducer, a delayed replica of each input signal delayed by a respective delay selected in accordance with the position in the array of the respective output transducer and said respective position in space such that replicas for transducers closer to the respective position in space are delayed more than replicas for transducers further from the position in space such that the sound waves of the channel are directed towards the position in space in respect of that channel;

summing, in respect of each transducer, the respective delayed replicas of each input signal to produce an output signal; and

routing the output signals to the respective transducers. **[Emphasis added]**

Claim 232 is amended to recite:

An apparatus for causing plural input signals representing respective channels to appear to emanate from respective different positions in space, said apparatus comprising:

a sound reflective or resonant surface at each of said positions in space;

an array of **at least 6** output transducers **in a single enclosure** distal from said positions in space; and

a controller for directing, using said array of output transducers, sound waves of each channel towards that channel's respective position in space such that said sound waves are re-transmitted by said reflective or resonant surface;

said controller comprising:

replication and delay means arranged to obtain, in respect of each transducer, a delayed replica of the input signal delayed by a respective delay selected in accordance

with the position in the array of the respective output transducer and said respective position in space such that replicas for transducers closer to the respective position in space are delayed more than replicas for transducers further from the position in space such that the sound waves of the channel are directed towards the position in space in respect of that input signal;

adders means arranged to sum, in respect of each transducer, the respective delayed replicas of each input signal to produce an output signal; and

means to route the output signals to the respective transducers such that the channel sound waves are directed towards the position in space in respect of that input signal. [**Emphasis** added]

Claim 239 is amended to recite:

An apparatus for causing plural input signals representing respective channels to appear to emanate from respective different positions in space, for use with reflective or resonant surfaces at each of said positions in space, said apparatus comprising:

an array of **at least 6** output transducers **in a single enclosure** distal from said positions in space; and

a controller for directing, using said array of output transducers, sound waves of each channel towards that channel's respective position in space such that said sound waves are retransmitted by said reflective or resonant surface;

said controller comprising:

replication and delay means arranged to obtain, in respect of each transducer, a delayed replica of the input signal delayed by a respective delay selected in accordance with the position in the array of the respective output transducer and said respective position in space such that replicas for transducers closer to the respective position in space are delayed more than replicas for transducers further from the position in space such that the sound waves of the channel are directed towards the position in space in respect of that input signal;

adders means arranged to sum, in respect of each transducer, the respective delayed replicas of each input signal to produce an output signal; and

means to route the output signals to the respective transducers such that the channel sound waves are directed towards the position in space in respect of that input signal. [**Emphasis** added]

The bold portions of the above claims show language added by the present amendment. The limitations introduced to the claims by this additional language are supported by the application in many places, including Figure 1 and page 25, line 7.

## CLAIM REJECTIONS

**Claims 224, 232, 239:** The Examiner rejects claims 224, 232, and 239 under 35 U.S.C. §103(a) as obvious in view of US Patent 5,870,484 to Greenberger (“Greenberger”) and US Patent 4,256,922 to Görike (“Görike”).

Claim 224 recites, in pertinent part:

... **providing, in one enclosure, an array of at least 6 output transducers** distal from said positions in space; ...

... obtaining, in respect of each transducer, **a delayed replica of each input signal** delayed by a respective delay selected in accordance with the position in the array of the respective output transducer and said respective position in space such that **replicas for transducers closer to the respective position in space are delayed more than replicas for transducers further from the position in space** such that the sound waves of the channel are directed towards the position in space in respect of that channel; ... [Emphasis added]

Claims 232 and 239 recite, in pertinent part:

... **an array of at least 6 output transducers in a single enclosure** distal from said positions in space; ...

... replication and delay means arranged to obtain, in respect of each transducer, **a delayed replica of the input signal** delayed by a respective delay selected in accordance with the position in the array of the respective output transducer and said respective position in space such that **replicas for transducers closer to the respective position in space are delayed more than replicas for transducers further from the position in space** such that the sound waves of the channel are directed towards the position in space in respect of that input signal; ... [Emphasis added]

## GREENBERGER

In the embodiments of Greenberger, a maximum of four transducers are located in any single enclosure (see Figures 16a and 22). Accordingly, Greenberger does not disclose: **providing, in one enclosure, an array of at least 6 output transducers or an array of at least 6 output transducers in a single enclosure.**

The embodiments of Figure 16a and 22 of Greenberger are merely slightly different alternative constructions to provide exactly the same effect as is provided in the embodiment of Figure 13a.

In Figure 13a of Greenberger, the left- and right-channel signals are routed unperturbed to the left and right transducers respectively. In addition, a delayed right- and left-channel signal is inverted and routed to the left and right transducers respectively.

In the embodiment of Figure 22 of Greenberger, for example, the delayed left- and right-channel signals are inverted and routed to separate transducers that sit alongside the left and right transducers for the unperturbed signals. Accordingly, Figure 22 of Greenberger simply provides extra transducers for the inverted and delayed signals whereas Figure 13a adds the signals together and uses only two transducers. The effect in both cases is exactly the same.

As in the embodiment of Figure 13a of Greenberger, the embodiment of Figure 22 delays the signal closer to the respective position in space LESS THAN the signal further from the position in space. Taking the example of the left signal (L), the signal closest to the left-hand position is completely non-delayed, whereas that furthest from the left-hand position is delayed (and inverted).

Figure 9a of Greenberger shows a slightly different embodiment utilizing three transducers. Here, the delayed and inverted signals are added together and output through a central transducer.

### **PRESENTLY CLAIMED INVENTION**

The presently claimed invention is distinguished from Greenberger in that **an array of at least six output transducers is included in a single enclosure and in that the signal replicas for transducers closer to the respective position in space are delayed more than the signal replicas for transducers further from the position in space.** This can be seen in Figures 16B and 16C of the present application where sound is shown being directed to the right. In such cases, progressively higher delays are applied as one moves from the left to the right (i.e. towards the respective position in space). The relationship between delays of neighboring transducers can be linear, as shown in Figure 16B, or non-linear, as shown in Figure 16C. In both cases, the effect of directing a sound beam to the right is achieved.

Any directional effect disclosed in Greenberger is provided using a completely different mechanism. In particular, Greenberger discloses providing a delayed and inverted signal close to a non-delayed and non-inverted signal so as to provide a cardioid radiation pattern. This can be achieved in a plurality of ways. In the embodiment of Figure 13a of Greenberger, two transducers are used – one transducer for the non-delayed signal and one for the delayed and inverted signal. The delayed and inverted signal for one channel is superimposed on top of the non-delayed signal for the other channel, such that only two transducers are required.

As discussed above, a yet further modification utilizing four transducers is shown in Figure 22 of Greenberger. Here, each of the delayed and inverted signals is provided with its own dedicated transducer. The effect in all cases is the same and relies on there being two, and only two, transducers for any particular channel.

## INVENTION NOT OBVIOUS

There is no obvious way to modify any of the embodiments of Greenberger so as to utilize more than two transducers for each channel. This is because the systems disclosed in Greenberger work on the principle of transmitting a non-delayed and non-inverted signal very close to a delayed and inverted signal to obtain a cardioid pattern. See Greenberger at col. 11, lines 19-54. The direction of any sound wave produced will be in the direction from the inverted and delayed signal toward the non-inverted and non-delayed signal. Greenberger at col. 12, lines 8-17. At the time of the invention, there was no obvious way to add further transducers. In particular, a person having ordinary skill in the art would not know where to put further transducers and whether to delay and/or invert the signals routed to such extra transducers. This is because Greenberger relies on the very specific phenomenon of a cardioid radiation pattern that is taught to be achieved only by using two transducers per channel.

The present inventors have suggested a completely different mechanism for sound transmission. In particular, they have suggested using six or more transducers in an array and providing successively increasing delays towards the direction of sound propagation. See Figures 1, 16B, and 16C; and page 25, line 7 of the present application. This configuration allows much narrower beam patterns than are possible with the Greenberger device. Note the very wide beam patterns shown in Figure 8A of Greenberger. The configuration in the present invention also allows greater power to be achieved due to the use of multiple transducers. Furthermore, the beam can be directed in virtually any selected direction simply by adjusting the electronic delay values. In contrast, any directionality in Greenberger is fixed to the direction lying on a line that joins the centers of the two transducers for any channel. See Greenberger at col. 12, lines 8-10.

It is therefore submitted that it was not at all obvious to modify the Greenberger device so as to provide **an array of at least six output transducers** for each channel and so as to provide that signal **replicas for transducers closer to the respective position in space are delayed more than the signal replicas for transducers further from the position in space**. The teaching of Greenberger itself is directly contrary to the teachings of the present invention because Greenberger teaches to apply a greater delay for the transducers further away from the position in space.

## GÖRIKE

Görike does not address any of the deficiencies of Greenberger.

Any directional effect achieved in Görike is achieved merely through physically rotating the transducers to point in a particular direction. This is particularly evident from Figure 3 of Görike. Here, the transducer 24 directs sound in the straightforward direction and the transducer 26 directs sound towards the right-hand wall 27. The transducer 26 directs the sound in this direction purely due to its placement. Görike therefore teaches to point a transducer in a particular direction if sound is to be transmitted in that direction. Görike does not disclose to a person having ordinary skill in the art how to make **an array of at least six output transducers** to transmit a sound beam in any selected direction, even when the transducers themselves are all

facing in the same direction. See Figure 16B and Figure 16C of the present application. Of the two prior art references, the only known mechanism for obtaining a directional effect through delays is found in Greenberger, and this involves using only two transducers per channel and inverting and delaying the signal to one of the transducers. See Greenberger at col. 11, lines 19-54.

The delays disclosed in Görike are for a completely different purpose, namely to give the impression of a large auditorium in a small room. See Görike generally. The theory in Görike is that if a signal arrives from the side some time after a similar signal that arrives from the front, the user will perceive the effect of being in a large auditorium. Görike does not disclose directing sound in any way other than by pointing the transducer in the particular direction. See Görike at Figure 3.

There was absolutely no reason for one having ordinary skill in the art at the time of the invention to apply the delays of Görike to the device of Greenberger. It is not at all technically clear how the person could apply the delays of Görike to the device of Greenberger. Görike teaches that a sound signal coming from the side should be more delayed so as to give the illusion of a large auditorium. Applying this to, e.g. Figure 8 of Greenberger, the hypothetical person having ordinary skill in the art would simply delay the signals for each channel that contribute to the signal that the listener perceives as coming from one side. This would result in ALL of the signals being delayed. Accordingly, applying the additional delay of Görike so as to achieve the illusion of a large auditorium would NOT give the result that signal **replicas for transducers closer to the respective position in space are delayed more than the signal replicas for transducers further from the position in space**. Although the signal for the transducer close to the respective position would be delayed, the signal for the transducer further from the respective position would be delayed even more, in order to ensure that the signal is directed in the correct direction.

The Examiner's contention that a person having ordinary skill in the art would simply swap the delays applied to the signals in Greenberger in view of Görike is a hindsight assertion that completely ignores the technical constraints of the system. If the delays of Greenberger were swapped, the beams would be directed in the opposite direction and, thus, the respective position would also swap sides. In such a case, the signal for the transducer closer to the respective position would still be delayed less than the signal for the transducer further from the respective position. Simply swapping the delays of Greenberger does not provide a system falling within the claims of this application.

Although Görike discloses in Figures 13 and 14 a **single enclosure having 6 transducers**, a **delayed replica of each input signal** is not **obtained in respect of each transducer**. Rather, taking the example of Figure 13 of Görike, the left-hand channel signal is output through the transducers 33, the right-hand signal is output through the transducers 32 and a combination of the left and right-hand signals is output through the transducers 28, 29, 30 and 31. Accordingly, the maximum number of transducers that output a replica of the same input signal is four. These front four transducers each receive a signal that is not delayed at all.

In view of the fact that Greenberger and Görike, alone and/or in combination fail to disclose subject matter that would fall within the scope of claims 224, 232, 239,

Applicant respectfully submits that the claims should be allowed.

**Claims 225 – 231, 233 – 238, and 240-242:** The Examiner also rejects claims 225 – 231, 233 – 238, and 240-242 under 35 U.S.C. §103(a) as obvious in view of Greenberger and Görike. However, given that these claims depend from claims 224, 232, and 239, which Applicant has shown to be patentable over the prior art, Applicant submits that these claims should also be allowed.

### CONCLUSION

For the foregoing reasons, Applicant submits that all of the pending claims are patentable over the cited prior art and respectfully requests the Examiner to allow the claims. If the Examiner has any questions or believes that the matter may be advanced by speaking with Applicant's attorney, he is invited to phone the undersigned.

Respectfully submitted:

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